

Distributions and biogeochemical cycles of platinum in seawaters at coastal areas around Japan

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Platinum, one of the rarest elements in the earth's crust, is now widely used in a range of products, such as catalytic converters in automobiles and anticancer drugs. Increasing use and dispersal of platinum has the potential to affect aquatic environments. In the urban aquatic environment, direct release from storm sewers draining roadways, and indirect release from sewage plants that treat road run-off, might be possible sources of Pt in waters. In previous studies, Pt concentrations in aquatic environments were rarely reported. Platinum concentrations in open ocean water have been found to be very low (about 0.2 pmol/L; Colodner et al., 1993; Suzuki et al., 2014). Recently, Pt levels have been reported in estuarine waters (~0.84 pmol/L; Cobelo-García et al., 2013; Cobelo-García et al., 2014; Mashio et al., 2016), and river waters (0.07-35 pmol/L; Obata et al., 2006; Mashio et al., 2016) which became higher at urban areas. However, the distribution of dissolved Pt in coastal waters has not yet been reported. In this study, we determined dissolved Pt concentrations in seawaters along the Boso to Sanriku coasts of Japan, and examine the behavior of platinum in these areas.

Seawater samples were collected during the research cruise KT-13-1 of RV Tansei-maru. Samples were filtered with 0.2 µm pore size capsule filters and acidified using high-purity hydrochloric acid. We determined sub-picomolar levels of dissolved Pt using isotope-dilution Inductively Coupled Plasma Mass Spectrometry (ICP-MS) after column preconcentration with an anion exchange resin (Suzuki et al., 2014).

Dissolved Pt concentrations were found to be in the range 0.20–1.5 pmol/L, with the highest concentration in bottom water of the Boso coastal area, and at stations close to Tokyo Bay. Vertical Pt profiles were similar to those in the open ocean at trench area, while the concentrations increased with depth at coastal stations. Assuming thermodynamic equilibrium, Pt was estimated to be present in the form $\text{PtCl}_5(\text{OH})^{2-}$, even in low-oxygen coastal waters. At continental shelf stations, Pt concentrations increased with depth, indicating that coastal sediments are another potential sources of dissolved Pt to coastal waters.